Bean Plant Structure & Function Lab

I. Pre-Lab Information & Questions

***ALL BOLD QUESTIONS/PROMPTS MUST BE ANSWERED FOR THE PRE-LAB**

2 types of bean plants (**kidney beans** & **pinto beans**) have been germinating for 1 month under several conditions:

1. Given only tap water every 3 days.

2. Given tap water & other nutrients (nitrogen, calcium, phosphorous) every 3 days.

Transpiration is the process by which plants lose water from their leaves. The movement of water is caused by 4 things:

1. Transpiration: Resulting from water potential, meaning water moves from areas of low water potential (a lot of water present) to areas of high water potential (little water present).

- **Would transpiration occur faster on a hot, dry day or a hot, humid day? Explain using principles of Water Potential.**

2. Adhesion: Water molecules adhere (stick) to sides of vascular tissue (XYLEM): specialized tubular cells functioning to transport water.

3. Cohesion: Water molecules attracting each other.

- **What would happen to the water column moving up the stem if a gas bubble formed? Explain.**

4. Tension: Force pulling the water column up the stem, resulting from the 3 previous conditions combined.

A major regulator of transpiration is a structure called the stomate. Stomata (plural) are tiny pores on the leaf surface (epidermis) that can open or close based on supporting structures called guard cells. Stomata allow water to leave/enter the leaf cells *but also allow CO_2 to enter leaves*.

- **Use your textbook to draw stomata in open and closed positions.**
- **Would it be beneficial for plants in <u>all</u> environments to have the same number of stomata? EXPLAIN.**
- **Would an aquatic plant (one that lives completely submerged in water) undergo transpiration? EXPLAIN.**
- **Would the *surface area* of leaves have any effect on the rate of transpiration? EXPLAIN.**
- **Develop a question, null hypothesis & experimental procedure that can be addressed using the plant specimens (one or both) & the methods described below. Data must be analyzed with a statistical test.**

General Transpiration Measurement Procedures

1. Place the tip of a 0.1 mL pipette into a 16 -inch piece of clear plastic tubing.

2. Submerge the tubing and the pipette in a tray of water. Draw water through the tubing with a syringe until **all** the air bubbles are eliminated.

3. Obtain a plant sample by digging and cutting at the roots. Carefully cut your plant stem under water. This step is very important, because no air bubbles must be introduced into the xylem.

4. While your plant and tubing are submerged, insert the freshly cut stem into the open end of the tubing.

5. Bend the tubing upward into a "U" and tape against a wall in the U shape.

6. If necessary use petroleum jelly to make an airtight seal surrounding the stem **after** it has been inserted into the tube. **Do not put petroleum jelly on the end of the stem.**

7. Let the potometer equilibrate for **10 minutes** before recording the time zero reading.

8. Read the level of water in the pipette after the equilibration period (time zero) and record in the data table below.

9. Continue to record the water level in the pipette every **3** minutes for **24** minutes and record the data table.

***** You will construct your own data tables as per your experiment**

10. The final data will be in a converted form as per the procedures below

Calculation of Leaf Surface Area by the Leaf Trace Method:

After arranging all the cut-off leaves on the grid below, trace the edge pattern directly on to the grid. Count all of the grids that are completely within the tracing and estimate the number of grids that lie partially within the tracing. The grid has been constructed so that a square of four blocks equals 1 cm^2. The total surface area can then be calculated by dividing the total number of blocks covered by 4. Record the value below.

Leaf Surface Area: _____ cm^2

Divide each measurement from your experiment by the leaf surface area and use these as your final data.